# Glass Alloy in Microgravity (GAMMA), Phase I

Completed Technology Project (2018 - 2019)

## Project Introduction

MIS is pioneering the use of the microgravity environment on the International Space Station (ISS) for manufacturing and product development. MIS has leveraged NASA SBIR support to create the first polymer additive manufacturing machines in space, develop a hybrid additive-subtractive metal manufacturing technology, and investigate the creation of large single-crystal industrial materials in microgravity. The next step in the industrialization of LEO is the formulation of base materials, such as specialty glasses, that can be refined into higher value products in microgravity. The Glass Alloy Manufacturing Machine (GAMMA) is an experimental system designed to investigate how these materials form without the effects of gravity-induced flows and inform process improvements for commercial product development. While focused around creating fluoride glass preforms, the system can also be used to melt a host of glass compositions, experiment with different dopants, and start the process of creating larger and higher quality glasses aboard the ISS. The initial system development focuses on remelting glass materials originally created on the ground and quantifying differences with ground control experiments. However, MIS plans trade studies to find more complex glass experiments, such as processing the constituent powders into samples, containerless processing, varying gravity levels, and other experiments which can only be performed on the ISS platform.

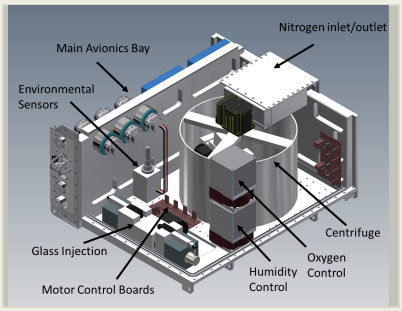
## Anticipated Benefits

Exotic optical fiber can be used in many different applications such as lasers, spectroscopy, high-grade sensors and other items that NASA and the Department of Defense could use. Because of the unique properties when manufacturing fiber in space, specific types of fiber gain tremendous value by lowering the attenuation and reducing microcrystals in the glass yielding a much better product.

**Telecommunications, Networking, and Information:** Technological companies handling large amounts of data daily would all be interested in having better performance over a wider bandwidth.

**Sensors and Imaging:** Better coverage in the mid-IR regions for sensors provides new applications for many industries

**Lasers:** Mid-IR fiber lasers are enabled by the specialty optical fibers investigated here, and are attractive due to high efficiency, excellent beam quality, and broad gain bandwidth

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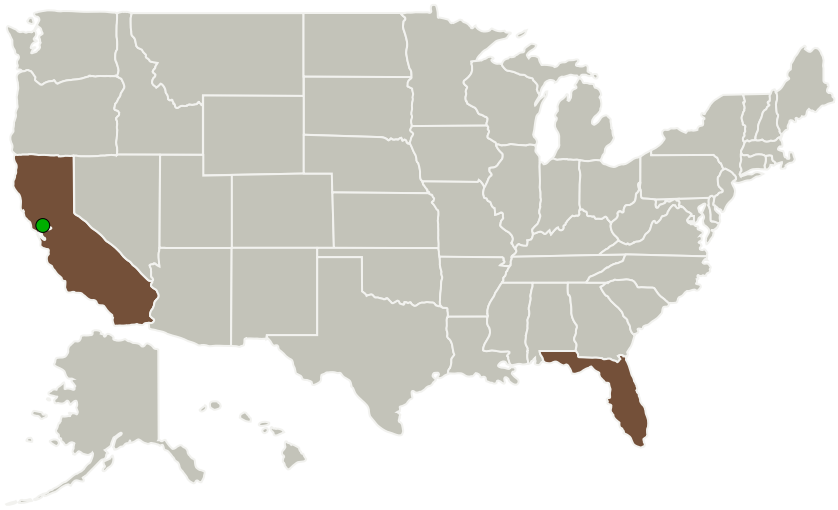
## Primary U.S. Work Locations and Key Partners



| Organizations Performing Work | Role | Type | Location |
|---|---|---|---|
| Made in Space, Inc. | Lead Organization | Industry | JACKSONVILLE, Florida |
| Ames Research Center(ARC) | Supporting Organization | NASA Center | Moffett Field, California |

| Primary U.S. Work Locations | |
|---|---|
| California | Florida |

## Project Transitions

**July 2018:** Project Start

**February 2019:** Closed out

**Closeout Documentation:**

- Final Summary Chart*(https://techport.nasa.gov/file/141066)*

## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Organization:**

Made in Space, Inc.

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

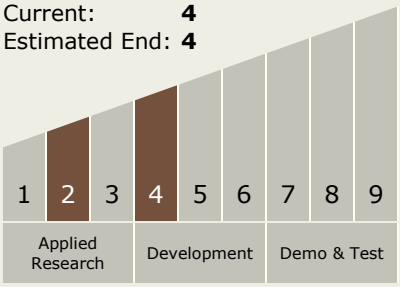
Carlos Torrez

**Principal Investigator:**

Jan Clawson

## Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



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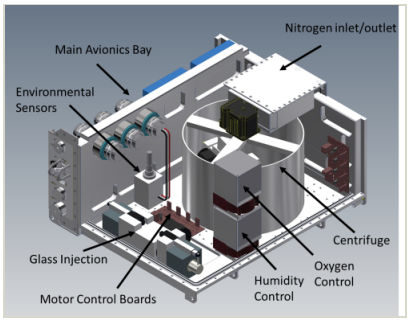
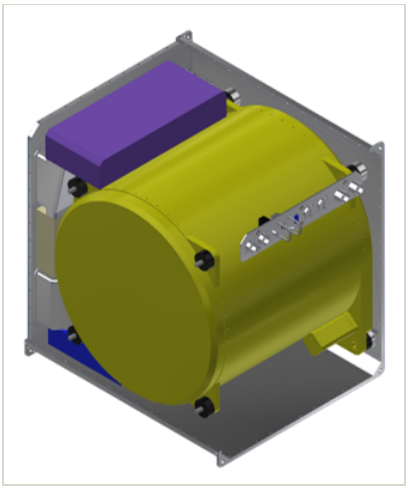
## Images




**Briefing Chart Image**
Glass Alloy in Microgravity (GAMMA), Phase I
*(https://techport.nasa.gov/image/132465)*



**Final Summary Chart Image**
Glass Alloy in Microgravity (GAMMA), Phase I
*(https://techport.nasa.gov/image/136063)*

## Technology Areas

**Primary:**

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.4 Manufacturing
    - TX12.4.1 Manufacturing Processes

## Target Destination

Earth